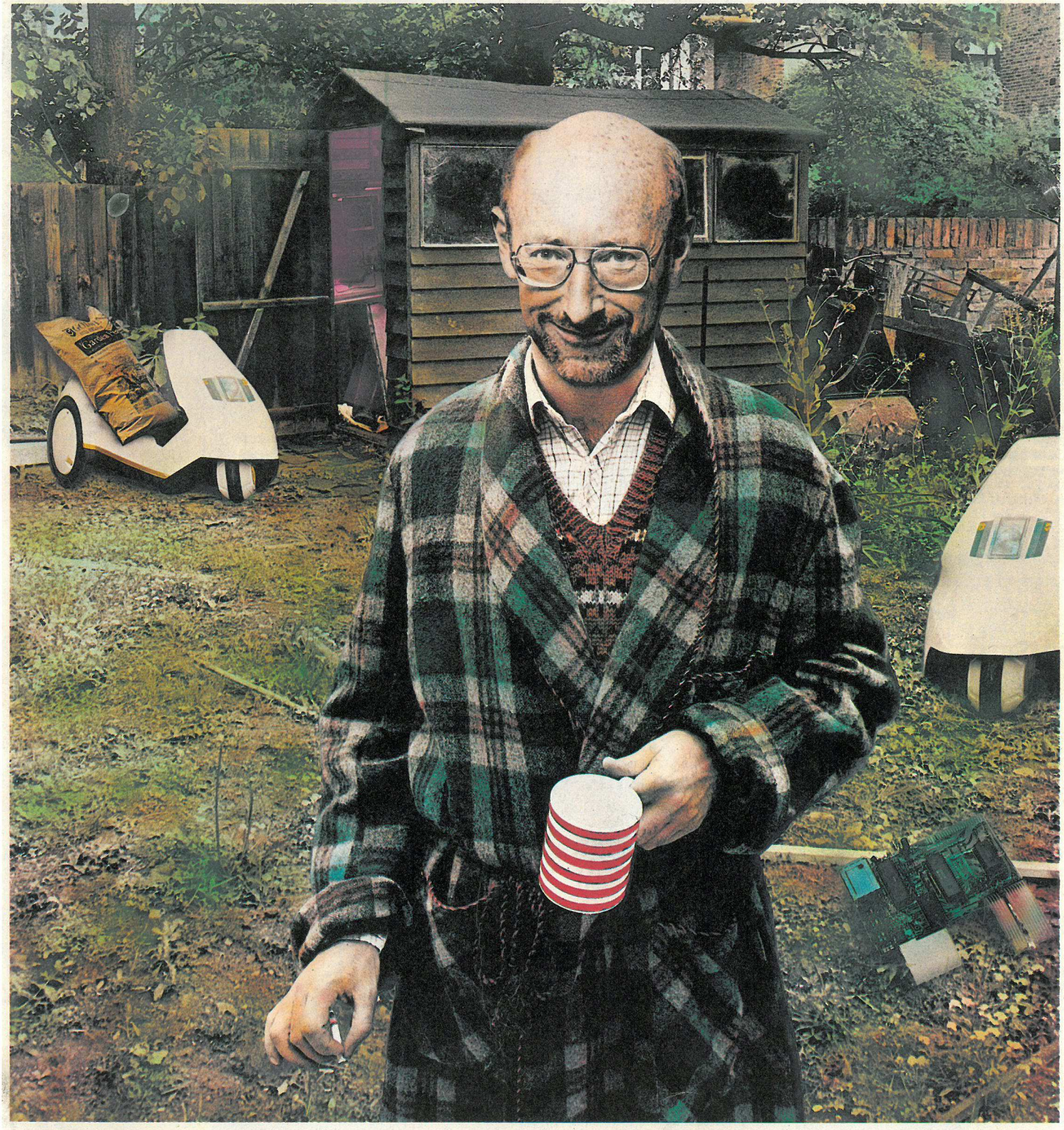
U.S.A. (by air) $2.50 Australia A$2.00
New Zealand NZ $2.85 Malaysia M$4.90 ISSN 0028 6664

12 June 1986 No 1512 Weekly £1.10

newscientist

THE DECLINE OF THE SINCLAIR MYTH



Photomontage by Michael Bennett

In praise of diversity • A universe of small triangles

Rex Feature

The decline of Uncle Clive

Knighted by Margaret Thatcher and widely considered as the most well-known scientist in Britain, the chairman of Sinclair Research seemed unstoppable. What went wrong?

Ian Adamson and Richard Kennedy

ON 7 APRIL 1986, Clive Sinclair sold off his name and rights to all existing computer products to Amstrad. With this single, dramatic move, he has effectively withdrawn from the market in home computers that his products played a major role in creating. When Sinclair signed the deal with Alan Sugar of Amstrad, Sinclair's products held the largest share (around 35 per cent) of this declining but still lucrative field. Sinclair's decision to opt out at this point illuminates several recurrent problems with his entrepreneurial style.

It also raises questions about the viability of Sir Clive's future operations. Alternative offers (favoured by Bill Jeffrey, the managing director of Sinclair Research) would have allowed the computer business to continue, and avoided many of the redundancies, which involved 95 per cent of the workforce. However, the price of the alternative deal was that Sir Clive would become a minority shareholder. The history of the decline of Sinclair's earlier company, Sinclair Radionics, subsequent to 1977, when Sinclair became a minority partner and the National Enterprise Board took the helm, showed that loss of absolute control, with the attendant obligation to take into account the views of others, soon becomes intolerable to a partner programmed to run a one-man show.

Sinclair's decade of fame and (mostly) favour, which resulted in both his knighthood and the less-inspiring sobriquet of "Uncle Clive" among the enthusiastic young purchasers of his high-tech toys, is mainly the result of the popular success of the "ZX" series of computers, from the ZX80 to the ZX Spectrum. While his predominant social contribution was to promote mass addiction to computer games, Sinclair has been widely misrepresented—not least by those centres of learning that gave him honorary degrees for "services to computer literacy and education"—as the man who brought computers into the home. This is not strictly true, if we understand by "computer" a functional tool with several related applications, whose design increases the ease or efficiency with which we can perform such tasks.

Sir Clive's marketing achievement was to downgrade the "concept" of a computer to the point where he could claim to provide one for less than the magical £100 mark. To this end, efficient keyboards and monitors, useful amounts of memory, effective filing and storage systems and the like were stripped away, to leave an affordable facsimile of a "computer". The market image was more important than what the computer could do, but the burgeoning industry in computer games provided an application which adolescents—young and old—eagerly seized on as the *raison d'être* for their new gadget. In the main, it was ignorance of genuine computer technology that fired the success of the ZX range, despite the availability of accessories that, albeit inefficiently, turned the Z80 processor chip at the heart of these up-market toys into the core of a useful machine.

The QL microcomputer marked Sinclair's attempt to move out of games and into the market of true home computers and computers for small businesses. The launch was a multi-faceted disaster. The original concept—an affordable, portable and genuinely useful computer, with a flat-screen display, adequate memory, built-in communications modem and "free" software to perform basic functions—was viable, as attested to by Amstrad's later success with its less ambitious purpose-built word processor, the PCW8256. However, Sinclair's penchant for idiosyncratic technologies led the company to waste time and effort on trying to produce a workable flat-screen display, using Sinclair's modified cathode-ray tube. Other delays in the development of the QL resulted from the choice of a new but inefficient microdrive

(a system which uses a fast audio cassette based on a continuous tape loop) as the medium for storing data.

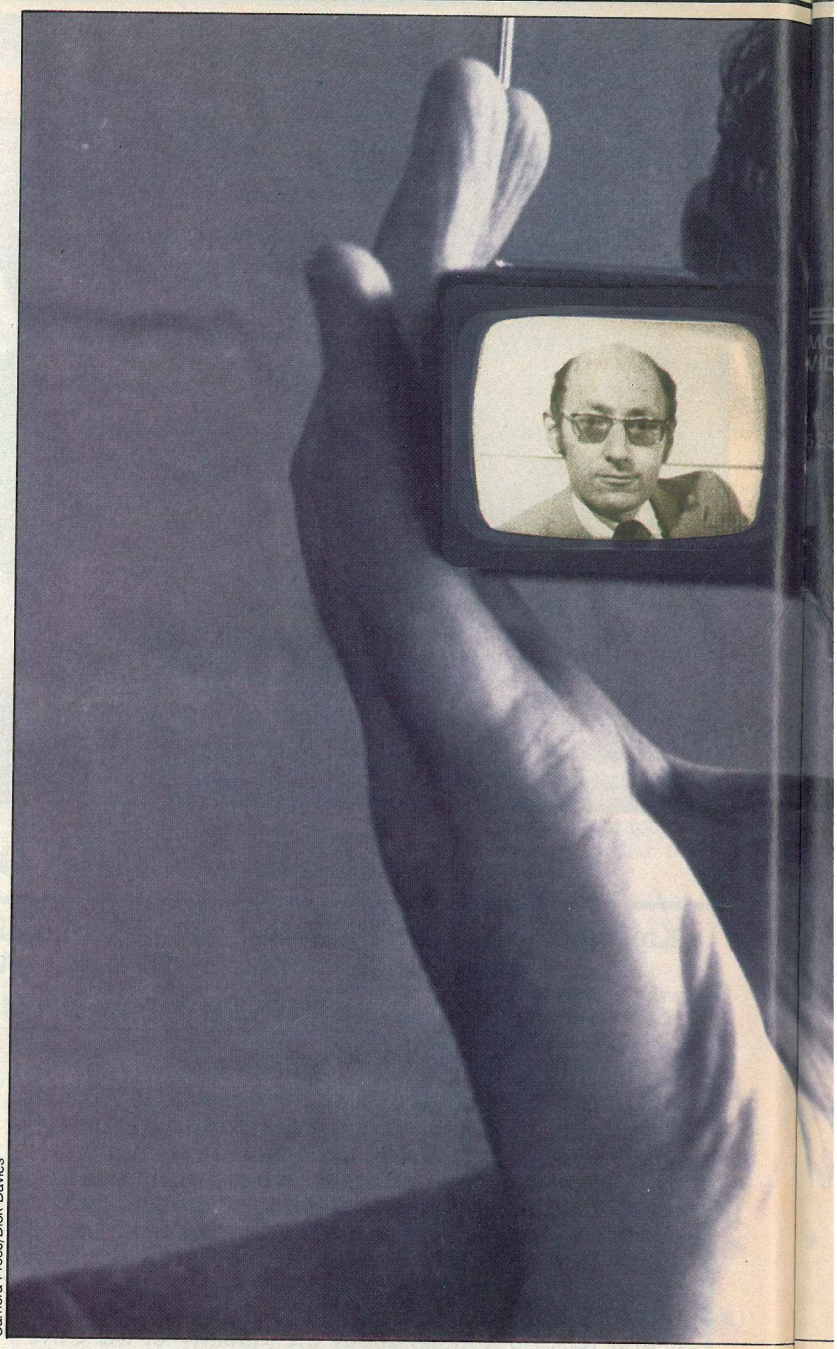
Another characteristic of Sinclair, launching products before they were really ready, reached its apotheosis in the high-profile launch of the QL. At the time, not even the company's engineers had seen a complete working prototype. The consequent deficiencies in the machine, and the delay of around a year before the QL became an available and adequate computer, prevented the support of a maturing market which, although ready for a product of this type, was wary of investing in unconventional technologies. There was very little software available at the time of the launch. Poor quality control, from Sinclair's practice of contracting out the manufacture of his products, meant that too many machines did not work when they reached customers. Alan Sugar was quoted as saying that Sinclair's quality control was "atrocious". These shortcomings were also factors in the failure of the QL. The public did not want an "innovative" machine for which they would, as Sinclair's staff belatedly admitted, form a test-bed. They wanted a reliable, functional and staid application of proven technology.

The working man's boffin

The significance of Sir Clive's corporate decline, otherwise a minor event in the commercial world, is that he has worn the mantle of a great British inventor (the term he prefers), innovator and entrepreneur. He has been identified in the public eye with the visible application of microchip technology—what might be termed high-street high-tech. His corporate failings are likely to be equated with the failure of British "high technology" as commonly understood. In fact, Sir Clive's talents lie in absorbing and adapting original research to develop inexpensive products, often of dubious utility (witness the flat-screen pocket television and the C5 electric tricycle), and marketing them initially by mail order to increase his profit margins and finance his production. People confuse his valid commercial role (where validity can be measured in terms of corporate profits and marketing success), with the popular myth of the inventor beavering away in his lab. The image of Uncle Clive, the working man's boffin, is one that Sinclair's public relations machine has relentlessly promoted. We should base any assessment of Sir Clive's prospects not only on his success or otherwise in directing his R&D staff creatively to exploit existing technology, but also his recurrent problems with production and occasional failures, both technical and commercial.

What of the future for Sinclair Research? One major factor is cash flow. There may be no current debts, and some retained profit from the deal with Amstrad, but apparently the only income will be royalties received from ICL on sales of the modified Sinclair technology incorporated in the One-Per-Desk "workstation"—an intelligent telephone system—plus any of his own assets (much diminished by the fiasco of the C5) that Sir Clive chooses to make available. Any future must depend on bringing new and viable products to the market quickly, or attracting sufficient financial backing for longer-term ventures.

Leaving aside Sinclair's declared intention to become a "think-tank" for selected clients—a dubious role for the "visionary" who brought us the C5, one might think—Sinclair has three projects in prospect. On the computer front, the company is developing Pandora, a portable microcomputer, bearing a remarkable resemblance to the original QL, but by all accounts omitting microdrives in favour of 3·5-inch disk drives. That Sinclair is still revising the specification of this product suggests a state of confusion that does not bode well for the timely arrival of a competitive and functional product. Amstrad has first refusal on marketing the Pandora, and it is unlikely to take on anything unless it accords with Alan Sugar's dictum of "the right product, at the right price, and at the right time". On past form, Sinclair's R&D team seem unlikely to achieve this, leaving Sinclair



Camera Press/Dick Davies

Research the task of starting again with minimal resources and little credibility as a designer of computers, in a field where companies such as Epson, NEC and Tandy are expending intense technical effort.

The second project, emanating from Sinclair's low-profile telecommunications laboratory based in Winchester, is the cheap portable telephone for cellular networks. This will sell for less than £100, says Sir Clive, tilting at his magic figure once again. The product should be on the market in 18 months' time. This is manifestly a viable product, as Alan Sugar has also decided, since his company also intends to produce one. So the company jointly created by Timex and Sinclair to produce the telephone faces intense competition in an area where mere corner-cutting on the costs of components and production in the classic Sinclair style will not succeed in the long term—any more than Sinclair's computers faced up to Amstrad's challenge.

The third and most intriguing option—and the one which presents the most daunting technical challenges—is wafer-scale integration. This approach to the design of semiconductors offers financial savings by producing complete processing systems, laid down on a single wafer of silicon. It

The image of the inventor. High-tech products for the high street—but how useful are they? Ivor Catt (above) sold Sir Clive his patents to wafer-scale technology. According to who you speak to in the semiconductor industry, Catt is either a crank or a visionary

could also pave the way towards compact implementation of the new generation of processing techniques currently under development. The opening in 1983 of the prestigious Metalab research unit near Cambridge provided a base for the realisation of Sir Clive's visions, among them the much-publicised "Fifth Generation" project to develop artificial intelligence. Sinclair made patriotic noises about beating the Japanese at their own game—whatever that might be, and to what end. One of the elements of this fantasy was the investigation of wafer-scale integration.

Sir Clive's initiation into the world of the wafer took place in the summer of 1983, with the arrival of Ivor Catt who had answered Sinclair's advertisement for people to work at Metalab. Depending on who you talk to in the generally conservative semiconductor industry, Catt is either a crank or a visionary. For 20 years, he had been refining the theoretical foundations for a revolution in the semiconductor industry, and thus was tailor-made for the Sinclair project. Sir Clive took on Catt as a consultant and bought up Catt's patents to the wafer-scale process.

Catt himself has succinctly summarised the appeal of the wafer against existing chips and methods of manufacture: "I noticed that the silicon wafer was a hundredth of the cost of the total system, so why not use that cheap commodity to build the system on the wafer instead of sawing it up to form separate circuits?"

Currently, the computer industry produces multiple chips on each wafer of silicon. The production process involves chopping up the wafer, testing each chip and then separating the working chips from a significant number of faulty chips. The working chips, after mounting, wiring and packaging in plastic, become part of a larger system mounted on a printed circuit board. Catt's alternative method involves preserving the entire wafer (including the faulty chips), which has internal connections between chips so as to eliminate the printed circuit board. It also avoids the need to test and encapsulate each chip. An electronic logic test built into the wafer circuitry allows each chip to be tested. If functional, the chip becomes incorporated in the circuit and then tests an adjacent chip. Faulty chips are bypassed as a spiral sequence of working chips is established on the wafer. The simplest form would be a memory wafer, but there is a potential to develop new, alternative computer architectures on the wafer.

Throughout the 1970s, the attempt to realise such a

product dominated the R&D strategies of many of the semiconductor giants. ITT, Texas Instruments and Burroughs, among others, sunk undisclosed fortunes into the dream. The kiss of death for the wafer as an investment option was the debacle of Gene Amdahl, formerly a designer with IBM. Amdahl's pursuit of a "supercomputer" based on the wafer-scale attracted around $240 million in backing from heavyweights that included Sperry, Digital Equipment and the Bull Corporation of France. By June 1984, Amdahl's company, Trilogy, had conceded that it could not overcome the problems of implementing its version of wafer-scale technology.

The failure of the big boys came as no surprise to Ivor Catt, whose approach had always radically differed from those of his rivals. Axiomatic to Catt's technique was a reduction in the number of connections made to the chip. In the latter stages of Amdahl's mega-wafer, the doomed prototype had an astounding 1200 pins packed on to its 6·4-centimetre design. Since, according to Catt's theoretical design, communication with the wafer passed through the first chip on the spiral, his chips were designed as bipolar components, thus needing only two pins as connections.

Investment in the wafer

After years in the wilderness, the National Research Development Corporation eventually funded Catt's theories in the late 1970s. This at least enabled him to patent their implications. At Middlesex Polytechnic, Malcolm Wilkinson ran a research team which examined the problems of implementing Catt's work. Wilkinson and his team went on to develop their research with Burroughs, where they successfully realised a provisional "test structure". At this point, the project fell foul of company politics. A new and predominantly American management, presumably with the experience of Amdahl fresh in their minds, wanted nothing to do with research into wafer-scale technology.

Sir Clive's interest in the technology could hardly have come at a more opportune moment. At the end of 1983, his relatively small, if momentarily profitable, company was able to poach not only Catt, but Wilkinson and a significant proportion of the team from Burroughs. In time, valuable additions from research groups working in related technologies from Plessey, TI, STL and DEC, would arrive.

Although association with wafer technology does nothing to enhance his self-styled stance as inventor and innovator, Sir Clive's support of these discredited research objectives was undoubtedly a canny move at a time when Sinclair Research was in a position to fund such an enterprise. In acquiring Catt, Wilkinson et al. and the wafer-scale patents, en masse and cut-price, it is arguable that Sir Clive was making an acceptable high-risk investment in the future. Sinclair's appropriation of Catt's work mirrors his advocation and adoption of Denis Gabor's work in the development of flat-screen technology at Imperial College in the late 1950s.

In a relatively short time it looked as if the investment would pay dividends. By spring 1985, Wilkinson's research suggested that the company could economically produce a wafer with a memory of half a megabyte for Sinclair's ill-fated QL microcomputer. Unfortunately, at the same time, the price of conventional memory chips fell dramatically. A few weeks later the financial crisis at Sinclair Research came to a head, precipitating the sequence of events which ended in the abortive "rescue" by Robert Maxwell. It seems likely that Sir Clive's preoccupation with the wafer-scale project exacerbated his lack of interest in the computer division of Sinclair Research, hastening a deterioration of the financial crisis to the point of no return. The fact that Sir Clive later turned down an offer that would have ensured the survival of the computer products tends to support the impression that, as far as he was concerned, home computers were history. However, while Sinclair may have been intrigued by the "intellectual challenge" of wafer-scale, it is equally clear that his much-lauded vision was decidedly myopic.

As soon as it became apparent that wafers with memories were unlikely to provide the funding for more sophisticated research, Robb Wilmot, chairman of ICL, was recruited onto the research board as troubleshooter.

Wilmot's brief was to drum up investment for the wafer-scale project. He soon recognised a potential that had eluded Sir Clive. Up until Wilmot's intervention, Sir Clive's exclusive direction for research into wafer-scales was towards the enhancement and development of Sinclair's existing technology and projects. Wilmot approached the problem of investment with the conviction that a solution to the production of wafer-scale chips could propel Sinclair Research into a position where the company would challenge the leaders of the semiconductor industry.

According to Wilmot, wafer-scale chips could revolutionise the design and production of all types of computers, and play a major role in communications products and defence systems (particularly radar equipment). In other words, the development of wafer-scale technology seemed poised to take Sinclair Research well out of its depth. Ironically, the company's capacity to raise finance was in a sense impeded by the exciting potential of its R&D resources. The public's recognition of Sinclair Research's managerial, marketing and financial shortcomings called into question its corporate ability to exploit effectively such an innovation. During the crisis in 1985, the odds were stacked against even ICL's well-connected supremo, Wilmot, coming up with a result. Malcolm Wilkinson sums up the difficulties facing the project, which are the same today as they were six months ago: "It's semiconductors, which are bad news to the City at the moment . . . It's wafer-scale technology, which has had some notable failures . . . and then there are the problems that Sinclair Research has got, and questions about the viability of the business side of it."

As a broker commented when the price of shares in Amstrad fell following the announcement of the deal with Sinclair, "The City . . . gets wobbles in the stomach when the name of Sinclair is mentioned." In the event, Wilmot failed to find the backers. A fortuitous deal with the Dixon chain of shops enabled Sir Clive's company to struggle on into the New Year until Alan Sugar came to the rescue in April.

With the Amstrad deal came the announcement that two separate companies would continue the projects on the radio telephone and wafer-scale technology. Sir Clive made it clear that he would have no part in the day-to-day running of either corporation. Barclays, the company's bankers, agreed to a limited investment package for wafer-scale technology with Sir Clive retaining a majority interest in the company, and the bank having an option to take up minority holdings. Desperately under-capitalised, it is hardly surprising that the team researching into wafer-scale technology is directing its attention towards distinctly unspectacular goals. The only project announced by the company is a wafer with a memory of 5 megabytes. It remains to be seen whether the experimental pilot production achieved in September 1985 can be sufficiently improved to create a product that can compete with conventional memory components in 1987.

Ivor Catt has always insisted that memory products are merely an incidental spin-off from the main work of wafer-scale development. The main purpose of wafer-scale technology, he believes, is to assist in the design of systems that will revolutionise computer architecture. A growing number of computer theorists are inclined to view these developments with interest, but Sinclair's company is hardly in a position to fund such ambitious research programes. So while wafers may yet hold a hope for the future, it seems unlikely that they hold out much hope for Sir Clive. □

Ian Adamson and **Richard Kennedy** are freelance authors and journalists. They have based this article on research for *Uncle Clive*, a critique of Clive Sinclair's technical and managerial practice, to be published by Penguin Books next September.